

**REMARKS**

In response to the requirement for restriction, the applicants elect the claims of the examiner's Group VI, claims 21 through 24 for further examination. Of the remaining claims, the method claims of the examiner's Groups IV and V, claims 15 through 20 have been cancelled. The claims of the remaining Groups I through III have been amended to depend from claims of the elected Group, and are therefore now also included in that group.

Early and favorable action on this application is earnestly solicited.

Respectfully submitted,

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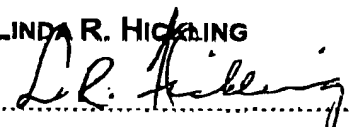
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**CERTIFICATION OF FACSIMILE TRANSMISSION**

I hereby certify that this paper is being facsimile transmitted to the Patent And Trademark Office on the date shown below.

LINDA R. HICKLING

  
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DATE: October 29, 2002

Amended claims with markings to show changes made

1. (amended) In a momentum management system according to Claim 22 [for attitude control of a spacecraft, the system having:

a housing to be fixed to the spacecraft;

a momentum wheel rotor in the housing and rotatable about a rotor axis for storing angular momentum;

a gimbal assembly mounting the rotor in the housing;

a drive having an output rotatable about a drive axis, the output being coupled to the rotor for rotating the rotor; and

a torque generation device for imparting torque to the rotor about axes orthogonal to the drive axis,

the improvement] wherein:

the gimbal assembly comprises a gimbal ring coupling the drive output to the rotor; and

the gimbal ring includes respective flexure joints connecting the gimbal ring to the drive and the rotor, the flexure joints being configured to permit the rotor to tilt about two flexure axes orthogonal to the drive axis, to incline the rotor axis through a range of angles from about 0 degrees to about 7 degrees with respect to the drive axis under the control of said torque generation device.

5. (amended) A momentum management system according to claim 22 [for attitude control of a spacecraft, the system having:

a housing;

a rotor drive having an output rotatable about a drive axis, the drive axis being fixed with respect to the housing;

a gimbal assembly connected to the drive output;

a momentum wheel rotor rotatable about a rotor axis for storing angular momentum, the rotor being mounted on the gimbal to be rotated about the drive axis by the rotor drive and for tilting movement about transverse axes orthogonal to the drive axis;

a torque generation device for tilting the rotor about the transverse axes; and  
a sensor for measuring the rotation of the rotor about the rotor axis], the sensor comprising:

a part spherical surface on the momentum wheel rotor;

a pattern formed on the part spherical surface; and

a sensor mounted at a fixed position relative to the housing and positioned adjacent the part spherical surface for detecting the passage of the pattern past the sensor with rotation of the rotor.

8. (amended) A momentum management system according to claim 22 [for attitude control of a spacecraft, the system having:

a drive having a rotatable output about a drive axis;

a gimbal assembly connected to the drive output;

a momentum wheel rotor rotatable about a rotor axis for storing angular momentum, the rotor being mounted on the gimbal to be rotated by the drive and for rotation about transverse axes orthogonal to the drive axis;

a torque generation device for imparting torque to the rotor about the transverse axes], the torque generation device comprising:

an inner permanent magnet annulus mounted on the rotor, concentric with the rotor axis and with poles spaced apart by a pole spacing dimension along the rotor axis;

an outer permanent magnet annulus mounted on the rotor, concentric with the rotor axis and spaced radially from the inner permanent magnet annulus, with poles spaced apart by the pole spacing dimension along the rotor axis;

a torque coil annulus between the inner and outer permanent magnet annuli and concentric with the drive axis, the torque coil annulus having a core with a dimension axially of the drive axis that is greater than the pole spacing dimension.

12.(amended) A momentum management system according to claim 22 [for attitude control of a spacecraft, the system having:

a drive having a rotatable output about a drive axis;

a gimbal assembly connected to the drive output;

a momentum wheel rotor rotatable about a rotor axis for storing angular momentum, the rotor being mounted on the gimbal to be rotated by the drive and for rotation about transverse axes orthogonal to the drive axis;

a torque generation device for imparting torque to the rotor about the transverse axes], the torque generation device comprising:

inner and outer permanent magnet annuli mounted on the rotor, concentric with the rotor axis and spaced apart radially with respect to the rotor axis;

a torque coil annulus between the inner and outer permanent magnet annuli and concentric with the drive axis; and

a ferromagnetic cage mounted on the rotor and surrounding the inner and outer permanent magnet annuli and the torque coil annulus.